

Energol

SOLAR
PRODUCTS



SOLAR PANEL INSTALLATION GUIDE AND OWNERS MANUAL



www.energol.com

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SOLAR PANEL INSTALLATION INFORMATION

If for any reason whatsoever, the installer of this product does not feel comfortable and/or safe do not proceed with the installation. The installation of this product involves walking on the roof as well as climbing ladders. Do not attempt unless you understand all safety procedures involved with power tools, climbing ladders and working on roofs. To obtain ladder safety, roof safety and power tool safety procedures, contact your local Hardware or Building Supply Company and State or Provincial Worker’s Safety Board.

The installation of Enersol Solar Panels may be performed on a low pitched (less than 12:12 or 45 degrees angle) shingle and some types of metal roofs. If an installation varies from these types, Enersol should be advised and asked for special installation instructions, visit our website or contact your roof manufacturer. **For example, on a flat roof installation, we do not advise cutting into the roof or drilling lag bolts into the roof.**



EnerWorks Inc., its agents, distributors and sales representatives of the Enersol solar products are in no way responsible if safety procedures, installation instructions and common sense are not followed, or if EnerWorks is not consulted should an unusual problem arise. EnerWorks assumes no liability for installation, parts or labor. If for any reason, you question the installation instructions, safety procedures and/or installation locations, do not proceed, and contact EnerWorks immediately at: 1-877-268-6502.

Remember... SAFETY FIRST!

PANEL BOX

- 1 section with pre attached headers
- 2 clips
- 3 lag bolts
- 2 O-rings
- 1 long strap (48")
- 1 short strap (12")

TOOLS REQUIRED

- Ladder, Safety gear (safety glasses, fall arrest, and boots), Variable speed drill, 5/16" and 3/8" socket drivers, Level, Hacksaw, Chalk line, Utility knife, Caulking gun, Various tools (pliers, etc.)

INSTALLATION KIT (Purchased separately – 1 per install)

- 1 warranty card
- 1 installation guide/owner’s manual
- 1 orange installation tool
- 1 tube lag bolt roof sealant
- 1 tube O-ring lubricant
- 2 end caps assembly
- 2 O-rings
- 1 Lag bolt and short strap (12")

ADDITIONAL PARTS REQUIRED

- PVC cement
- 1 ½" - 2" elbows
- 1 ½" - 2" tees
- 1 ½" – 2" pipe
- pipe hold downs (1 ½" and/or 2")
- 1 ½" – 2" couplers
- Extra lag bolts
- 3-way manual valve or Automatic controller with 3-way valve
- One way check valve
- 1 ½" – 2" ball valve
- Teflon tape

ASSEMBLY INSTRUCTIONS

OVERVIEW

1 - Plan your system:

- a) Determine the location; south is best followed by west or east. North is not recommended. Panels should be tilted at an angle of 45° or less.
- b) Determine the optimum number of boxes needed. The following quick sizing guide will help you establish the number of boxes of solar panels required for your pool. The lower number is for a south facing roof with full sun. If the roof is west facing or has more shade, you will need the larger number. The solar rule of thumb is 50% to 75% of the pool surface should be represented in solar panel area. Indoor pools require 100% coverage.

In Ground Pool	Pool Surface Area	1 x 8	1 x 10	1 x 12
12 x 24	288	18 - 27	14-22	12-18
14 x 28	392	25 - 37	20-29	16-25
15 x 30	450	28 - 42	23-34	19-28
16 x 32	512	32 - 48	26-38	21-32
18 x 36	648	41 - 61	32-49	27-41
20 x 40	800	50 - 75	40-60	33-50
Above Ground Pool				
15' Round	177	12 - 17	12-13	12
18' Round	254	16 - 24	13-19	12-16
21' Round	346	22 - 32	17-26	14-22
24' Round	452	28 - 42	23-34	19-28
27' Round	572	36 - 54	29-43	24-36
12' x 24' Oval	257	16 - 24	13-19	11-16
14' x 28' Oval	350	22 - 33	17-26	15-22
15' x 30' Oval	402	25 - 38	20-30	17-25
16' x 32' Oval	457	28 - 43	23-34	19-28
18' x 33' Oval	524	33 - 50	26-40	22-33
		Recommended number of boxes		

If panel area exceed number of sections that can be installed in one array (see table) panels must be split to equally sized arrays. See typical split-array reverse return.

Panel Size	Number of Boxes / Array
4' x 8'	7 - 9
1' x 8'	28 - 36
4' x 10'	6 - 8
1' x 10'	24 - 32
4' x 12'	5 - 7
1' x 12'	20 - 28
Custom size	Consult with EnerWorks



For additional information in sizing the system please see System Design considerations or call EnerWorks for assistance at: 1-877-268-6502.

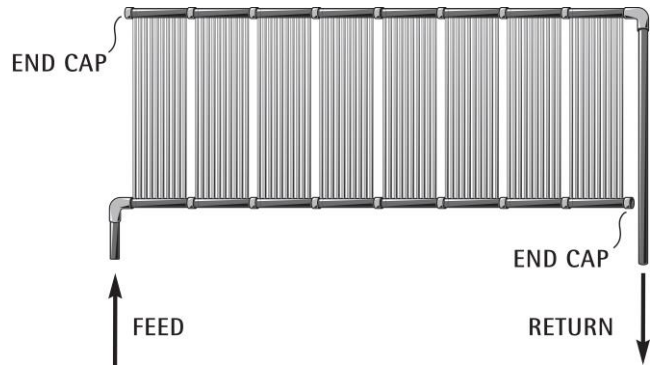
- c) Measure roof area available to be sure the panels will fit: Panels must be positioned vertically from eave to peak with at least 6" space around the panels for plumbing and workspace. Four sections of connected headers measure 51" and rubber panel strip width measures 48".
- d) There are several different types of roofs. Most will accommodate the entire panel system in a continuous row. However, some systems may need to be split over two or more arrays or two or more roofs. When splitting a system, you must balance equal sections in each array. Remember to be conscious of the best sun exposures, and avoid roofs with shade.
- e) Check that your existing pool pump is in good working order. Verify that pool pump is sized accordingly and that it will not exceed the maximum panel flow. For information on pump size see **System Design Considerations** or consult with EnerWorks at **1-877-268-6502.**

- f) Plan for the plumbing and fittings required. Ensure no to exceed maximum velocities allowed on pipes when selecting pipes diameters as per table below. See **System Design Considerations** (page 13) for more information on how to size the line set, or consult with us at: **1-877-268-6502**. EnerWorks recommends between 6 – 8 fps when sizing pipes for pool systems.

Pipe Size	Velocity	
	6 fps	8 fps
1-1/2"	35 gpm	50 gpm
2"	62 gpm	85 gpm
2-1/2"	90 gpm	120 gpm
3"	140 gpm	187 gpm

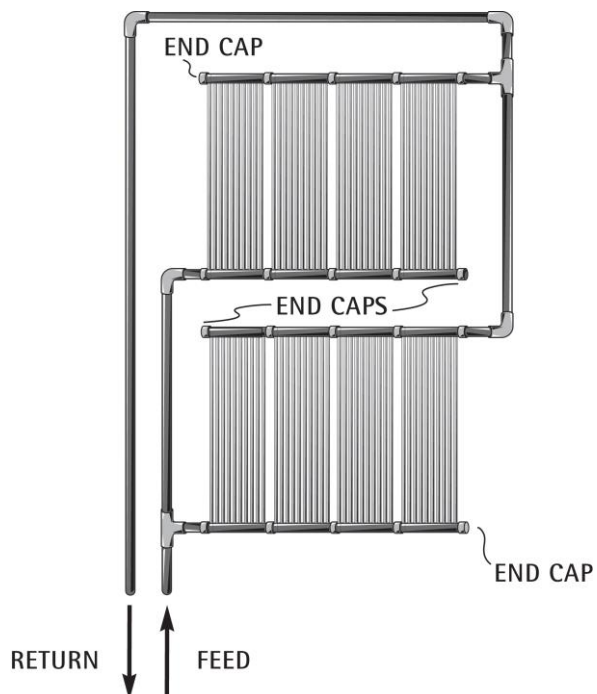
- g) Gather all components and tools required for the job.

TYPICAL PARALLEL ROOF

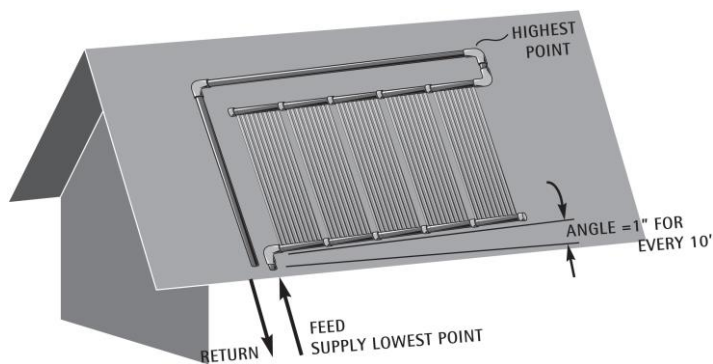


TYPICAL SPLIT-ARRAY REVERSE RETURN

When installing more than the recommended maximum number of collectors or when there is some space limitation on the roof (i.e. a series of small roof), the array has to be split into two or more banks following the reverse return configuration to ensure proper distribution of flow through the collectors.



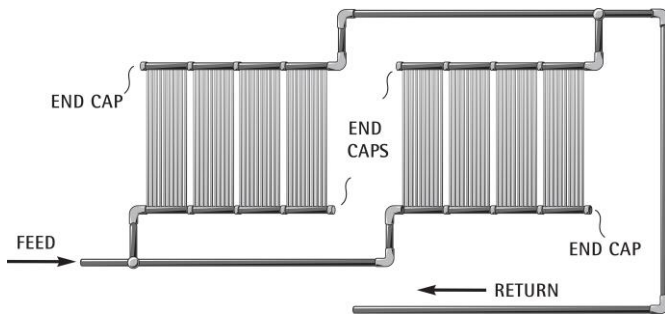
TYPICAL PITCHED ROOF MOUNT



Important: Angle panel headers inch for every 10 feet to drain water back to feed/supply inlet.

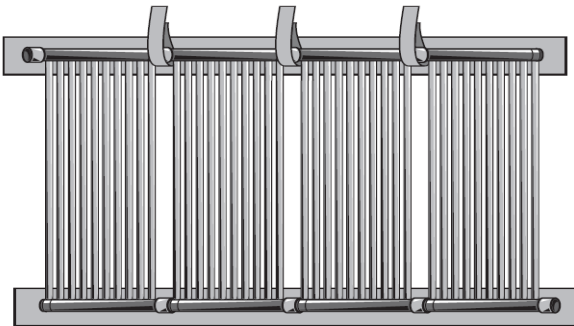
ASSEMBLY INSTRUCTIONS (CONTINUED)

TYPICAL SPLIT-ARRAY REVERSE RETURN (Horizontal array)



TYPICAL FLAT ROOF MOUNT

Attach headers to 2x6" lumber on each end. 2x6" lumber may then be attached to roof using liquid adhesive. Ensure that the rubber is not blocking any roof drainage.



TYPICAL GROUND MOUNT

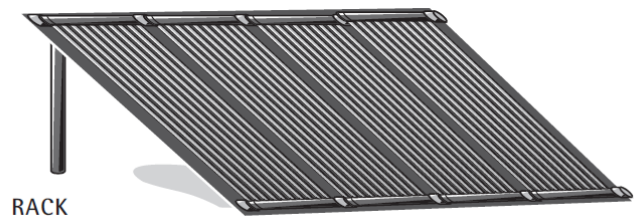
Support headers with 2x6" lumber. Panels may be set on any material that will insulate them from the earth: plywood, metal, plastic or gravel. Note: Flat roof or ground mount panels will not gain heat if sitting in puddles of water, always ensure proper drainage.



Important: Support headers with 2x6" lumber.

TYPICAL RACK MOUNT

For safety reasons do not mount panels against a pool. Rack plywood should be mounted 45° or less.



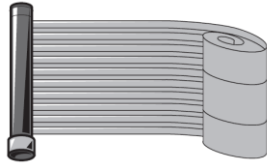
TYPICAL METAL OR TILE STYLE ROOF MOUNT

Attach top header to 2x6 lumber with straps supplied, and provide a rest for the bottom headers on 2x6 lumber (w/o strapping to allow expansion and contraction of the rubber), lumber may then be attached to roofing material using appropriate method. Always consult with the roof manufacturer for best practices.

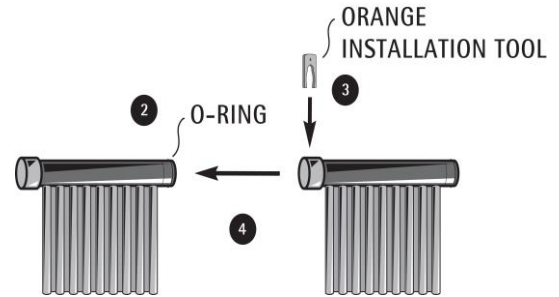
2 - Roll out panels on roof, rack or ground:

- a) Carry the boxes to the installation area.
- b) If installing on a roof – snap a chalk line as a guide to where the top of the panels will be aligned. It is important to place the panels on a slight angle on the roof. This helps purge the air from the system when filling, and provides drainage when draining for the

winter. Angle the panel headers 4” for every 40 feet with the slope down toward the end that has the feed line



until all the panels/sections are connected.



Remove from box carefully and unroll panels. If panels become tangled, lay flat and untwist strips from one end to the other

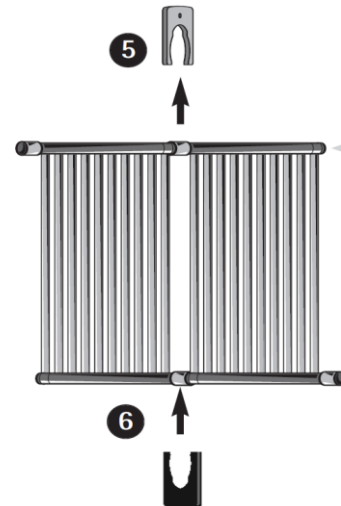


The orange installation tool must be used to prevent damage to the O-rings

- c) Carefully take the sections out of the box (give each roll a twist to tighten and pick up from the bottom to prevent tangling), set down, evenly arrange, and allow each section to unroll.



For best performance, install the panels with round tubes facing the sky. Therefore, more area available to collect heat during the day.



When connecting different versions of headers, always cut off locator tab before connecting.

3 - Clip together using the installation tool included with the required Installation Kit.

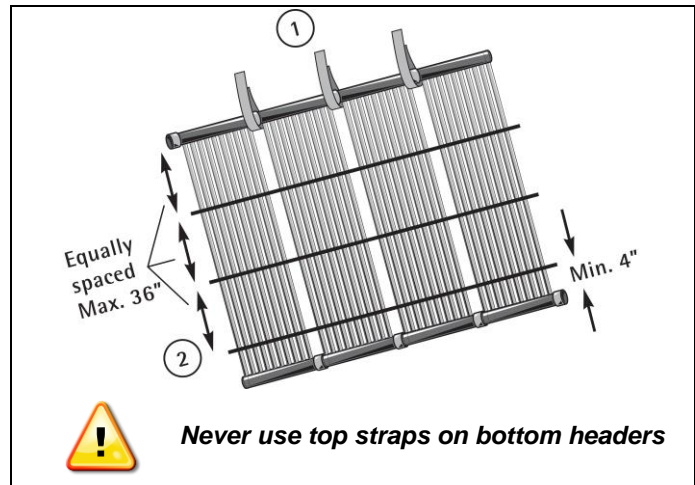
- a) Keep the top header close to the reference chalk line as you begin the assembly:
 - 1 put an O-ring on the first header
 - 2 lubricate the O-ring, with supplied lubricant (lithium based)
 - 3 clip the orange installation tool into the slot on the next header
 - 4 push the two sections together
 - 5 remove the installation tool
 - 6 insert black clip to complete the connection
- b) Continue this procedure for the top headers

4 - Strap down headers and panels

- a) Starting at the top end, secure the headers to the roof by placing header straps (12” long) on every clip connection.
- b) Loop the strap around the top header, bring the two grommets together and push the threaded lag bolt through the grommets. Check for proper tension, apply a generous

dab of roof sealant on the chalk line and secure the lag bolt to the roof. Repeat this for every header until complete the top row strap installation.

- c) On steeper roofs, you may want to strap the headers one at the time while you are making the connections to prevent the entire assembly from slipping down.
- d) Always straighten the bottom headers by pulling gently and join together as the top headers (see step 3), Bottom headers are not strapped down.



ASSEMBLY INSTRUCTIONS (CONTINUED)

- e) To complete the securing process, cross strapping (48” long) is used. The straps are attached grommet to grommet across the entire width of panels. Starting from the top, the cross straps should be equally spaced at no more than 36 inches apart. Fasten using the proper lag bolts and roof sealant provided. The last row, nearest to the bottom should be around four inches from the bottom header. Bottom headers are not strapped down to allow for expansion and contraction of the panels. When installing longer custom sizes panel they may require additional horizontal strapping.
- f) If your roof has a membrane, or cannot be punctured, it is possible to attach a lumber frame to the roof with liquid nails adhesive and attach the lag bolts into the lumber. (Contact your roof manufacturer for advice).

Attach to Roof

1 Top strap: Install a strap every section across top only.

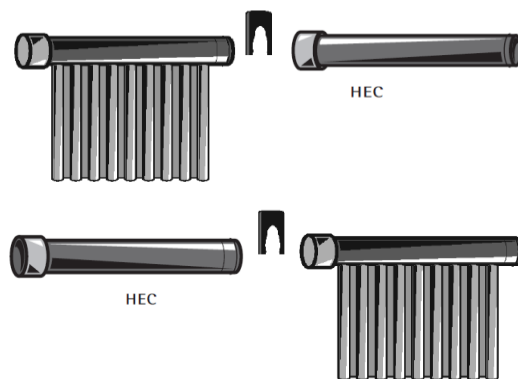
2 Cross Strap: Install Cross strapping equally spaced along the length of the collector, making sure to leave at least 4 inches from bottom. Apply a generous amount of roofing sealant. Screw lag bolts through roofing sealant into roof. Use roof sealant liberally with all lag bolts into roof.

PLUMBING

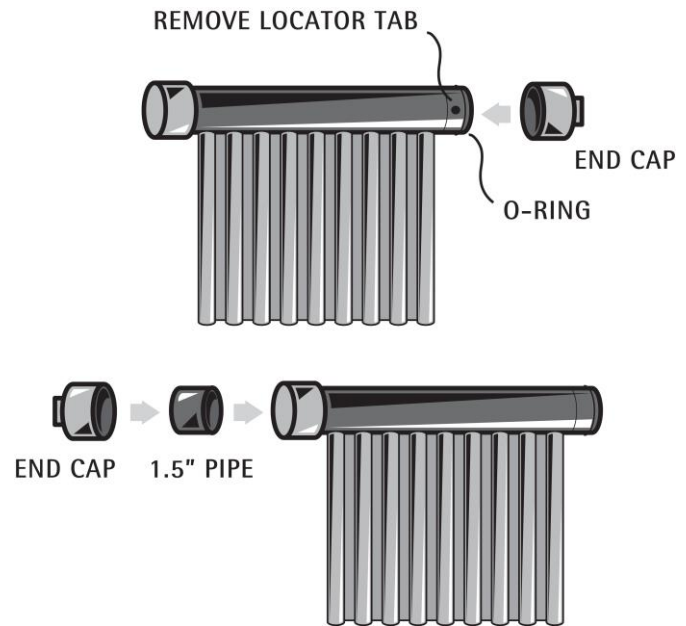
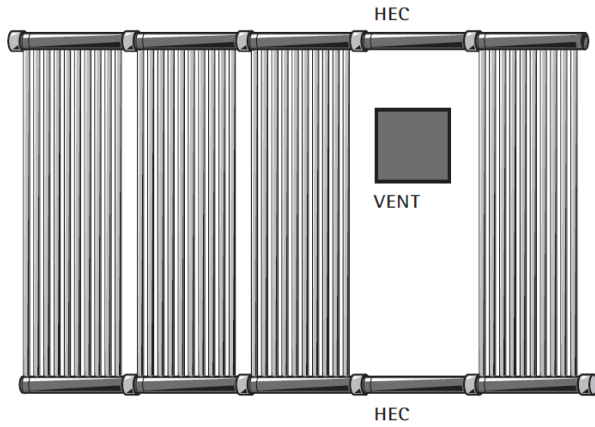
5 - Connect Plumbing

Join Plumbing to Headers

- a) The Header End connector (HEC) included in your *installation kit* creates a male and a female adapter. Clip the header end connectors (HECs) to the headers, diagonally opposite of one another, at the input and output of the array so that the plumbing can be glued to the HEC instead of the header. Remember the feed line goes in the bottom and return comes out the top on the opposite side.



HECs can also be used as spacers around small roof vents or similar obstacles. (Purchased separately – see drawing below)



Join end-caps to Headers

- b) Connect the end caps to the remaining headers. To do this liberally apply cement to the inside lip end of the end cap, steering clear of the threading.

FOR MALE END:

- Remove O-ring
- Cut locator tab off
- Apply PVC cement liberally to both male and female surfaces
- Cement together

FOR FEMALE END:

- Cut a piece of 1.5" pipe to 3" long
- Apply PVC cement liberally to all surfaces and glue together

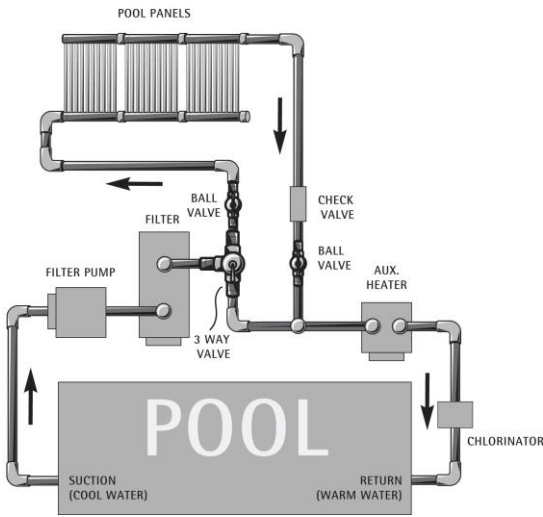
Always use Teflon tape on the removable threaded plug of the end cap to prevent leaking (removable threaded plug can be removed to allow for drainage).



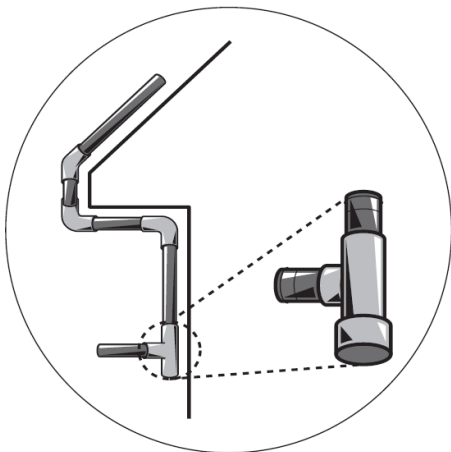
Use Teflon tape on all End Caps

- c) Complete the roof installation by connecting the supply and return water lines: measure twice cut once! If you are travelling a substantial distance from the panels to the pool, consider insulating the underground pipes.
- d) Plumbing Layout:

Cool feed from pool (water sensor) ➡ pump ➡ filter ➡ manual or automatic valve ➡ ball valve (flow regulator) ➡ solar panels (panel sensor) ➡ return from panels (check valve) ➡ auxiliary heater ➡ salt generator/chlorinator ➡ return to pool



- e) The recommended 1.5" or 2" PVC pipes are attached to the roof and side of the house with plastic clamps and secured with lag bolts and roof sealant
- f) Be sure to measure and dry fit all pieces to ensure a proper and neat fit around all eaves troughs, then cement (using grey heavy-bodied PVC cement) the connections and assemble. The pipes should be secure, straight, even and close to the house.
- g) At any low point in the plumbing use a tee and end cap. This will allow for drainage.



At any low points in plumbing, use a tee and end cap to allow for drainage during winter months

SYSTEM REGULATION OPTIONS

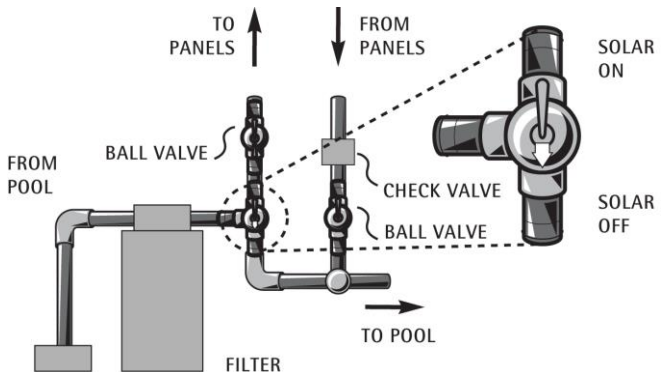
6 - A valve is necessary to divert the water to the panels.

- a) A **3-PORT MANUAL VALVE** can be used; it must be turned on and off manually when the temperature fluctuates during the day to get the most out of the sun, and must be turned off at night. The valve is installed in the feed line from the pool, with the water coming into the inlet opening. The handle can then be turned to divert the water to the panels on sunny days or directly to the pool, when not using the panels. Remember that the water flows in the direction that the free part of the handle is pointing, and the Indicator points to the closed side.



If manual valve is left "ON" for long periods of cold weather or at night pool will lose heat

3-WAY MANUAL VALVE



- b) A **CHECK VALVE** is optional, but suggested, to be installed on the return line. This will prevent back flow to the panels, and is also required for the **Summerization** of the system. In some cases a check valve can prevent losses from heat thermo siphoning out of the pool.

- c) An **AUTOMATIC VALVE** relies on water and panel temperature sensors to divert the water. EnerWorks suggests the Aqua Solar controller kit. The kit comes with a 3-port diverter valve, actuator, control box and two sensors. Follow manufacturer’s instructions for installation of automatic control box, motorized valve (actuator) and controls.
- Install the Control Box as outlined in manufacturer’s instructions. Be sure to wire correctly.
 - The 3-port valve (diverter) is installed as above.
 - Remove the locking knob and handle.
 - Remove 4 screws from the valve (fit actuator on valve to determine which screws to remove).
 - Align the actuator; rotate the actuator until holes on the actuator align with the screw holes.
 - Use the 4 supplied screws to secure in place.
 - Plug the actuator in the Control Box in the “**FWD VALVE**” socket.
 - Flick the switch to **SOLAR TEST**. Synchronize the valve handle by flipping the toggle switch at the bottom of the actuator between **ON 1** and **ON 2** to rotate the handle so it points to the solar panel feed line. See full instructions for valve actuator in package, or visit our web site, www.energol.com and look under “*System Automatic Controller*”.

d) WATER SENSOR

Install the plastic cylinder shaped sensor by drilling a 5/16” hole into the pipe usually between the filter and diverter valve. The gear clamp holds the sensor in place. Two wired connectors are supplied to connect the sensor to two line sensor wire. The other end is wired into the control box (pool sensor screws).

e) PANEL SENSOR

Install the sensor on the roof or rack where it receives sunlight similar to the solar panels. Two wire connectors are supplied to connect the sensor to two wire sensor cable. The other end is wired into the Control Box (solar sensor screws). The plastic wire protector fits in the hole located in the bottom of the control box.

f) OHM-METER

Use an Ohm meter to check the resistance in the sensors. The Ohms readings should correspond with the sensor temperature. Use the chart below to determine if the sensor is sensing proper temperatures.

Temp °F	Kohms	Temp °F	Kohms
65	13.5	95	6.5
70	11.9	100	5.8
75	10.5	105	5.2
80	9.3	110	4.7
85	8.2	115	4.2
90	7.3	120	3.8

Finally, double-check all your joints, plumbing and wiring. Pressure test the system to test for leaks, then let the cement set for 3 hours. Turn your filter pump back on to get the water flowing.

- Manual Valve: Turn handle to divert water to the panels.
- Automatic Valve: Flick the switch to “Auto”.

Congratulations! Enjoy your warm pool for many years.

Best Regards,

Team EnerWorks

SYSTEM DESIGN CONSIDERATIONS

a) **Line Set:** in this guide “line set” refers to the piping system carrying the water to and from the solar panels. Typically recommended values for water velocity on pipe are between 6 and 8 feet per second (fps). In order to properly size line set diameters you need to know the flow rate of the system to ensure not exceeding max velocity. Always check with local regulations to ensure compliance. Failure to properly size line set diameters will cause early deterioration of the piping. The table below shows the water flows in different pipe sizes with the corresponding velocities.

Pipe Size	Velocity	
	6 fps	8 fps
1-1/2"	35 gpm	50 gpm
2"	62 gpm	85 gpm
2-1/2"	90 gpm	120 gpm
3"	140 gpm	187 gpm

Line set length also has a negative effect on losses; the longer the pipe the higher the losses. A very large line set (more than 100 feet) will create additional losses to the solar system, which can be translated into higher operating pressures. When using large runs of pipe (more than 100 feet) is recommended to increase the pipe diameter to the next available size to minimize the losses. If losses exceed the operating pressure for the panels it may create leaks.

Table below illustrates the pressure loss on PSI for every 100 feet of pipes of different diameters.

GPM	Losses (PSI) per 100 ft	
	1.5" DIA	2" DIA
30	3.16	0.79
60	10.97	2.75
90	22.88	5.7

b) **Panel Array Size:** every component on a hydraulic system creates resistance or friction losses, pool solar panels do not escape this reality; care must be taken when determining the size of the pool panel array (especially on large pool systems) not to exceed the panel capacity. Use the table below as a guideline when determining the panel array sizes.

Panel Size	Number of Boxes / Array
4' x 8'	7 - 9
1' x 8'	28 - 36
4' x 10'	6 - 8
1' x 10'	24 - 32
4' x 12'	5 - 7
1' x 12'	20 - 28
Custom size	Consult with EnerWorks

When the pool is too large and requires more panels than the number recommended on table above, the array must be split into two or more parallel arrays of equal size interconnected using reverse return techniques.



Failure to properly size solar panel array may result in panel over pressurization and/or failure

For detailed information on pressure losses for the Energol solar panels please see Appendix 1.

c) **Flow rate:** flow rate is usually measured in gallons per minute (GPM) and is determined by analyzing the pump size, total losses from the hydraulic system, and turnover rate required. Adequate flow rate will ensure proper sanitation, even heat and chemical distribution in the pool. When installing a pool collector system on an existing pool, care must be taken not to interfere with the original system characteristics. Always follow the recommendations in this guide to avoid issues.

Important Note:

When retro-fitting an already designed pool with solar panels and with an oversized pump, a ball valve can be installed between the 3-port valve that

diverts the flow to the solar panels and be used as regulator valve to ensure proper flow, Alternatively a flow meter can be installed on the supply line to the collector to verify flow.

Pipe fittings also add losses to the system, excessive amount of fittings will increase the pressure on the hydraulic system affecting the flow rate. See table below for an equivalent length of straight pipe in Feet of losses added to the system for various fittings.

Friction Loss for Pipe Fitting	
90° elbow	7.4 to 11 feet added
45° elbow	2.1 to 4 feet added
Gate valve	1.2 to 1.9 feet added
Check valve	15 to 27 feet added
Coupling	.5 feet added



If assistance is required during the stage of a pool system please contact EnerWorks for technical support at: 1.800.884.6444

d) Turnover rate requirements are established by regulations in order to maintain proper sanitation levels on the pool water. Always check local regulations for TOR when designing a pool system. Below are typical TOR used on pool design:

- Public pools: water circulation = 4+ per 24 hrs / TOR of 6 hrs
- Commercial pools: water circulation = 2+ per 24 hrs / TOR 12 hrs
- Hot Tubs: water circulation = 48+ per 24 hrs / TOR 30 min
- Residential pools: water circulation = 1 per 24 hrs

- The Enersol System is not potable water compatible. Is not recommended for use with glycol, and cannot be used in a pressurized water system.
- The Enersol Pool panel is not designed for winter use.
- The recommended operating pressure for the solar panel is 15 PSI @ 120°F, with a maximum fluid pressure of 17 PSI @ 120°F (static pressure)
- Recommended flow rate for the solar panels is

0.166 gallons per minute for every square feet of solar panel (0.166 GPM / Ft²)

- Maximum flow per array is determined also by the size of the piping to and from the array. See *velocity table on page 13.*

ADDITIONAL TECHNICAL INFORMATION

- Use PVC pipe for plumbing, ABS is not UV stable and will degrade with outdoor use
- The Enersol solar panels are designed to be installed at a tilt angle of 45 degrees or less with the flow (rubber sections) running vertically from bottom to top header
- Do not install Enersol solar panel on a fence or wall at 90 degrees
- Avoid installing solar panels below the level of the pool, otherwise there will be pressure issues
- Use Weld-On 711 PVC cement or heavy bodied PVC cement.
- Ensure plumbing is straight. Measure twice cut once!
- One Installation Kit is needed for each installation. If you are installing multiple arrays, you will need extra end caps.
- At any low points in plumbing, use a Tee and end cap. This will allow for drainage in the winter months.
- Covering the panels with glazing (Plexiglas or glass) is not recommended.
- Always install solar panels of at least 50% of the pool area, and never less than 12 sections of 1 ft wide.

SOLAR PANEL STRAPING REQUIREMENTS FOR HIGH WINDS

For high wind areas additional strapping and anchoring may be required, depending of wind velocities and locations. Please contact us for instructions at:

1-877-268-6502

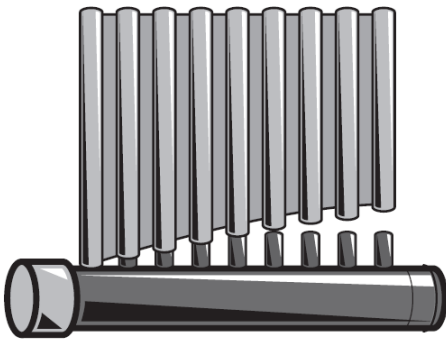
Or by e-mail through our web site:

www.enersol.com

MAINTENANCE AND TROUBLESHOOTING

Header or Rubber Replacement

Any header section or length of rubber can be replaced. To remove the rubber, push the rubber off with a flat screwdriver. Attach tubes to the headers by simply sliding them over the nipples. Warm the ends of the tubes in hot water momentarily. Push each tube on until it contacts the header and completely covers the nipple. No clamps are needed.



Always use a clip tool when disconnecting.

Tube Repair

Small isolated holes a splicer can be inserted to repair small isolated holes.

For repair parts contact your Enersol Dealer or call **1-877-268-6502**



IF A LEAK HAPPENS INSERT SPLICER

If a Section Develops a Leak

Allow 5 or 10 minutes for the O-ring to seat. Replace O-ring if marked, pinched, nicked or cut. Use O-ring lubricant as supplied.



WINTERIZATION OF YOUR SOLAR SYSTEM

Winterization must be done after your pool is closed.

- 1) Go to the highest point of the solar panels and pipes and open the top corner end cap. Remove the opposite bottom corner end cap. Without disturbing the top and bottom rows of headers, work your way along the panels and gently lift the rubber from top to bottom. If in doubt you can open a section and drain out excess water. Blowing the lines with a shop-vac may not remove all of the water.
- 2) Open all the end caps at down pipes, pump house and blow any underground lines. Make sure that no water remains in any low pipes, sags in pipe valleys or any part of the system. Reattach the end cap to ensure nothing enters header.
- 3) Valves must be turned to be halfway open or closed. On motorized valves, turn switch to **TEST** and let valve turn halfway. Pull the electric cord.

- 4) A general inspection of the roof at this time is wise. Check for loose lag bolts and strapping. Remove leaves and debris that might block the runoff of rain or snow.

SUMMERIZATION OF YOUR SOLAR SYSTEM

Summerization is done if the system is left for a prolonged period of inactivity in extreme heat conditions in excess of 150°F. This prevents no circulating water from becoming stagnant and promoting bacterial growth. The use of a drain down valve and end cap, and a one way check valve is necessary. Follow steps for Winterization.

Visit our web site for more information on repair tips, diagnostic and troubleshooting.

www.enersol.com

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Appendix 1:

Pressure Losses in PSI for 8', 10' and 12'
Energol solar panel

Pressure Losses on (PSI) for 8 feet long Pool Collectors									
		Width of Array (12 ft. = 12 x 1 ft. sections)							
		(12 ft)	(16 ft)	(20 ft)	(24 ft)	(28 ft)	(32 ft)	(36 ft)	(40 ft)
Flow in (GPM)	5	0.10959	0.101136	0.100394	0.103508	0.108825	0.115519	0.123131	0.131386
	10	0.262771	0.260394	0.27344	0.294198	0.319362	0.34728	0.377035	0.408074
	15	0.45285	0.46885	0.507984	0.558685	0.615996	0.677438	0.741634	0.807758
	20	0.677031	0.722774	0.799363	0.891375	0.9922	1.098533	1.208539	1.321114
	25	0.933578	1.019853	1.144686	1.288797	1.443925	1.605938	1.772541	1.942357
	30	1.626011	1.358448	1.541904	1.748494	1.968303	2.196375	2.429954	2.66739
	35	2.135387	2.019137	1.989458	2.268593	2.563151	2.867349	3.177972	3.493094
	40	2.704666	2.5602	2.486105	2.847604	3.22673	3.616872	4.014358	4.416985
	45	3.370114	3.157516	3.335781	3.484301	3.957608	4.443309	4.937272	5.437019
	50	4.049949	3.809879	4.027499	4.177648	4.754579	5.345281	5.945163	6.55147
	55	4.784378	4.516246	4.777075	5.247546	5.616608	6.321604	7.036699	7.758862
	60	5.572497	5.313589	5.583597	6.135611	6.808544	7.37125	8.210722	9.057905
	65	6.413509	6.121963	6.446257	7.085894	7.864632	8.493308	9.46621	10.44747
	70	7.306706	6.981243	7.364334	8.097633	8.989292	9.968797	10.80225	11.92653
75	8.251451	7.890837	8.375065	9.17014	10.18178	11.29254	12.21804	13.4942	

Example:

To read values on table match the panel size (collector) width (top) with the flow rate (left side), the number at the intersection represent pressure losses of the panel expressed in PSI. i.e. A pool solar panel array of 20 feet wide by 8 feet long will have a pressure loss of 1.5419 PSI at 30 GPM

Important: Shaded numbers on the tables indicates excessive pressure losses on the panels. Care must be taken not to exceed panel capacity by means of restricting the flow going to the panels or by splitting the array as per recommendations. If you have any questions during the design stage of your solar pool heating contact us at: **1-877-268-6502.**

Appendix 1: (continued)

Pressure Losses in PSI for 8', 10' and 12'
Energol solar panel

Pressure Losses on (PSI) for 10 feet long Pool Collectors									
		Width of Array (12 ft. = 12 x 1 ft. sections)							
		(12 ft)	(16 ft)	(20 ft)	(24 ft)	(28 ft)	(32 ft)	(36 ft)	(40 ft)
Flow in (GPM)	5	0.128868	0.115595	0.111961	0.113147	0.117087	0.122748	0.129557	0.137169
	10	0.301328	0.289312	0.296574	0.313476	0.335887	0.361739	0.389887	0.419641
	15	0.510686	0.512226	0.542685	0.587603	0.640783	0.699126	0.760913	0.825109
	20	0.754145	0.78061	0.845632	0.929932	1.025249	1.127451	1.234243	1.344249
	25	1.029971	1.092148	1.202522	1.336994	1.485236	1.642085	1.804672	1.971275
	30	1.84287	1.445202	1.611307	1.806329	2.017877	2.239751	2.468512	2.702091
	35	2.419398	2.190805	2.070428	2.336068	2.620987	2.917955	3.222956	3.533579
	40	3.063439	2.777059	2.578642	2.924719	3.292828	3.674708	4.065768	4.463254
	45	3.820482	3.424014	3.516125	3.571054	4.031968	4.508374	4.995108	5.489071
	50	4.588427	4.130336	4.244358	4.274041	4.837202	5.417576	6.009425	6.609306
	55	5.417644	4.894868	5.033296	5.433775	5.707493	6.401129	7.107387	7.822481
	60	6.3071	5.763956	5.88196	6.35247	6.974129	7.458003	8.287836	9.127308
	65	7.255883	6.637781	6.789481	7.33536	8.055114	8.587291	9.54975	10.52265
	70	8.263183	7.566288	7.755086	8.381643	9.206151	10.14047	10.89222	12.0075
75	9.328274	8.548828	8.825432	9.490597	10.42647	11.48624	12.31443	13.58096	

Pressure Losses on (PSI) for 12 feet long Pool Collectors									
		Width of Array (12 ft. = 12 x 1 ft. sections)							
		(12 ft)	(16 ft)	(20 ft)	(24 ft)	(28 ft)	(32 ft)	(36 ft)	(40 ft)
Flow in (GPM)	5	0.148147	0.130054	0.123529	0.122787	0.125349	0.129978	0.135983	0.142953
	10	0.339885	0.31823	0.319709	0.332755	0.352411	0.376198	0.402739	0.431209
	15	0.568521	0.555603	0.577387	0.616521	0.665569	0.720815	0.780191	0.84246
	20	0.83126	0.838446	0.8919	0.968489	1.058298	1.156369	1.259948	1.367383
	25	1.126364	1.164443	1.260358	1.38519	1.526548	1.678233	1.836803	2.000193
	30	2.059728	1.531956	1.68071	1.864165	2.06745	2.283128	2.507069	2.736793
	35	2.703408	2.362474	2.151398	2.403543	2.678823	2.968561	3.267939	3.574064
	40	3.422212	2.993918	2.671179	3.001833	3.358926	3.732544	4.117177	4.509523
	45	4.27085	3.690512	3.696469	3.657808	4.106329	4.57344	5.052944	5.541123
	50	5.126905	4.450793	4.461217	4.370435	4.919825	5.48987	6.073687	6.667142
	55	6.05091	5.273491	5.289517	5.620004	5.798378	6.480653	7.178075	7.886101
	60	7.041702	6.214324	6.180322	6.569329	7.139714	7.544757	8.364951	9.196711
	65	8.098256	7.1536	7.132706	7.584826	8.245596	8.681275	9.633291	10.59784
	70	9.219661	8.151334	8.145839	8.665653	9.42301	10.31213	10.98219	12.08847
75	10.4051	9.206819	9.2758	9.811054	10.67116	11.67994	12.41083	13.66771	